

# Householder's Perceptions of Insulation Adequacy and Drafts in the Home in 2001

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## Abstract

In order to improve the estimation of end-use heating consumption, the Energy Information Administration's (EIA), 2001 Residential Energy Consumption Survey (RECS), for the first time, asked respondents to judge how drafty they perceived their homes to be as a measure of insulation quality. The analysis of the 2001 RECS data shows that householders in newly-constructed homes perceived their homes to be better insulated and less drafty than do householders in older homes. Single-family homes are perceived to be better insulated and less drafty than are apartments in buildings with two to four units. Cross-variable comparisons also provide the associations between the level of insulation and winter drafts in the homes with household characteristics and location of the home.

## Introduction

In the past, EIA has tried to collect technical information regarding building shells and insulation. However, the effort has not been successful. Typically, the respondents<sup>1</sup> do not know technical details such as the type of insulation in their homes, the r-value<sup>2</sup> of the insulation, and the air infiltration rate. In 2001 RECS,<sup>3</sup> EIA tried a different approach. This approach relied on the respondents' ability to provide the energy-related details of their homes in another manner by asking questions that substitute, i.e., for insulation levels and building shell construction. These new questions concerned the level of insulation and draftiness of the respondent's home. There were two reasons for collecting this information. One was to have some estimates, however rough, of the extent of insulation; the other was to improve the estimation of space-heating consumption. EIA found that the respondents can usually provide a reasonable assessment of how well their home is insulated and how drafty their home is in the winter. More specifically, the following two questions were asked to collect these data:

### 1. Overall, would you say that your home is . . .

1. Well insulated,
2. Adequately insulated, or
3. Poorly insulated?
4. No insulation (if volunteered)
5. Don't know

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<sup>1</sup> The respondent can be: a) the person, or one of the persons, in whose name the home is owned or rented (householders), or b) the spouse or partner of the householder, or c) a spokesperson other than the householder or spouse or partner, when language problems or physical disability make it impossible to interview one of the above.

<sup>2</sup> r-value is a measure of a material's resistance to heat flow (EIA, 2003).

<sup>3</sup> See <http://www.eia.doe.gov/emeu/recs/contents.html> for more information about RECS.

2. **How often do you or other members of your household find your home too drafty during the winter? Would you say it is . . .**

1. All the time,
2. Most of the time,
3. Some of the time, or
4. Never?

The 2001 RECS was the first RECS to request household perceptions regarding the presence of winter drafts in the home. The data presented in this report are based on household answers to the above questions. This paper examines the relationship between reported perceptions regarding adequacy of insulation and winter drafts and housing unit/household characteristics, such as the type and age of housing unit, race, ownership, poverty level, and location of the home.

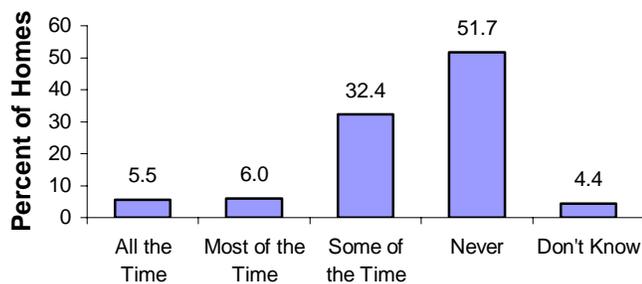
### Insulation and Winter Drafts

In 2001, of approximately 107 million households in the United States, the RECS data show that an estimated 52 percent of the homes were “never” too drafty during the winter (Figure 1).<sup>4</sup> About 32 percent were too drafty “some of the time.” Six percent indicated “most of the time,” and less than six percent were “all the time.”

Of the 107 million households, an estimated 40 percent were perceived to be “well insulated” and another 40 percent “adequately insulated” (Figure 2). About 18 percent were perceived to be “poorly insulated,” and less than one percent were estimated to have “no insulation.”

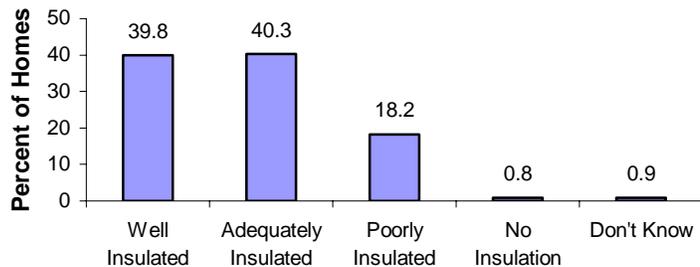
There were some differences in household responses. For example, among householders with “poorly insulated” homes, the RECS data show that 13 percent of the homes were “never” drafty,<sup>5</sup> and 40 percent of the homes were drafty “some of the time.”<sup>6</sup> Among householders that reported “no insulation,” 29 percent of the homes were “never” drafty.<sup>7</sup> There

**Figure 1. Distribution of Homes by Level of Drafts, 2001**



Source: Energy Information Administration, Office of Energy Markets and End Use, 2001 Residential Energy Consumption Survey.

**Figure 2. Distribution of Homes by Insulation, 2001**



Source: Energy Information Administration, 2001 RECS.

<sup>4</sup> All the data presented in the RECS are RECS estimates rather than exact measures for the population. More information on survey methods and data quality are available online:

[http://www.eia.doe.gov/emeu/recs/recs2001/append\\_a.html](http://www.eia.doe.gov/emeu/recs/recs2001/append_a.html) and  
<http://www.eia.doe.gov/emeu/recs/recs2001/appendixb.html>

<sup>5</sup> The proportion varied by regions. It ranged from about six percent in the Northeast to 14 percent in the South Census regions. See [http://www.eia.doe.gov/emeu/recs/census\\_map.html](http://www.eia.doe.gov/emeu/recs/census_map.html) to see the States that make up the census.

<sup>6</sup> The corresponding figures were 37 percent in the South and the West, 38 percent in the Midwest, and 42 percent in the Northeast.

<sup>7</sup> There were variations by regions. It ranged from zero in the Northeast to 33 percent in the West.

was a statistically significant relationship between the adequacy of insulation and the presence of winter drafts in the home.

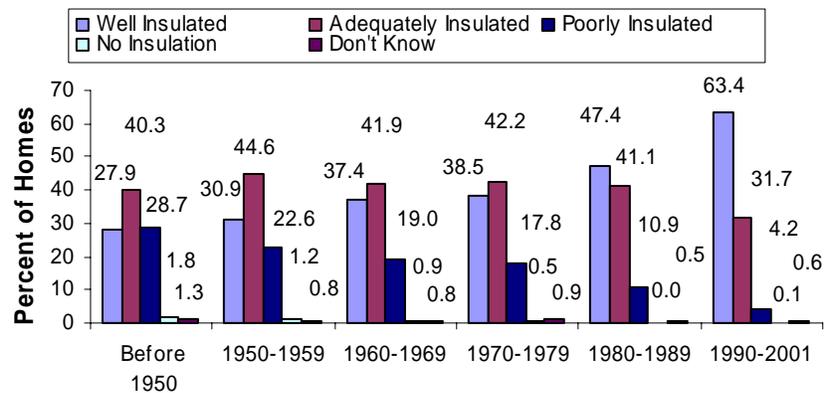
## Age of Housing

### Insulation

In a recent EIA study, also using RECS data, there was a statistically significant negative relationship between the age of the housing unit and the perceived adequacy of insulation (Figure 3): the newer the unit, the better the perceived level of insulation [Battles and Hojjati, 2004]. According to RECS data, about two-thirds of the respondents in new homes, constructed in 1990 through

2001, indicated that their homes were “well insulated.” Such responses were less frequent, 28 percent for households in older homes, built before 1950. The proportion of “poorly insulated” homes was four percent for newer homes, compared with 28 percent for older units.

**Figure 3. Insulation by Year of Construction, 2001**

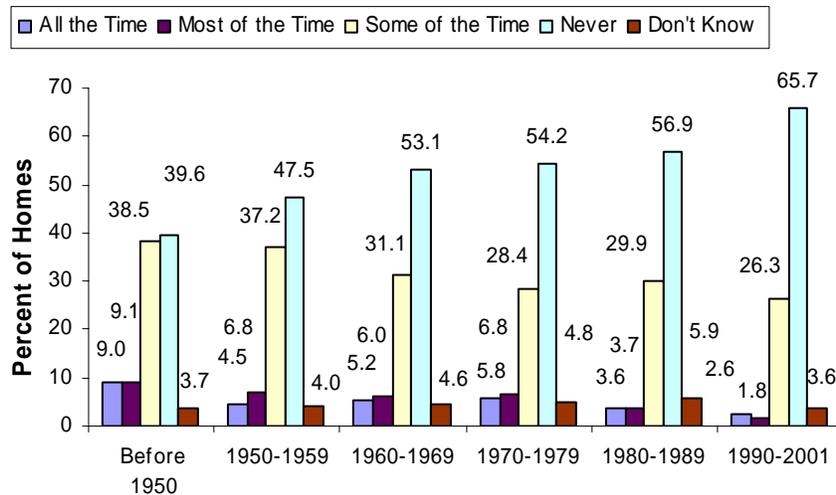


Source: Energy Information Administration, 2001 Recs.

### Winter Draft

Similarly, household perceptions as to the level of drafts in the home indicate a significant negative association between the level of drafts and the year of construction (Figure 4). The estimated proportion of homes that indicated they were either drafty “all the time” or “most of the time” was 18 percent in older units and 4 percent for newer homes, according to RECS data (Figure 4a). The estimated proportions of households reporting “never” drafty homes were 40 percent in older homes and 66 percent in newer homes. In addition, the proportion of homes that was drafty “some

**Figure 4. Level of Drafts by Year of Construction, 2001**



Source: Energy Information Administration, 2001 RECS.

of the time” declined from older to newer homes. The estimated proportions were 39 percent for homes constructed before 1950 and 26 percent for homes built in 1990 through 2001.

### Type of Housing

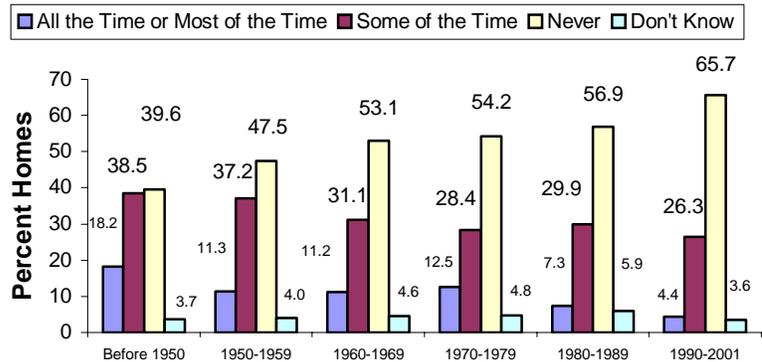
Based on RECS data, in 2001 about 59 percent of homes in the United States were detached single-family units, and 10 percent were attached single-family units (Figure 5). Less than 9 percent were apartments in buildings with two to four units (apartments in small buildings), 16 percent were apartments in buildings with five or more units (apartments in large buildings), and about 6 percent were mobile/manufactured homes.

### Insulation

The perceived adequacy of insulation varied by type of housing (Figure 6 ). The RECS data show that households in 41 percent of single-family homes (attached or detached), 40 percent of apartments in large buildings, and 32 percent of apartments in small buildings perceived that their homes were “well insulated.” Households in about 41 percent of detached single-family homes, 40 percent of attached single-family homes, 42 percent of apartments in large buildings, and 35 percent of apartments in small buildings perceived their insulation to be “adequately insulated.” It seems that apartments in small buildings were perceived to have lower levels of insulation. However, only the difference between the data for apartments in small buildings and single-family homes is statistically significant.

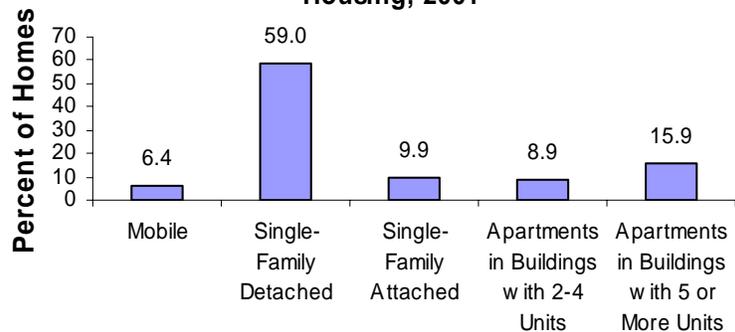
Among all types of homes, the RECS data show that the majority were either “well insulated” or “adequately insulated” (Figure 6a). The proportion ranged from 67 percent for apartments in small buildings to 82 percent for detached single-family homes.

**Figure 4a. Level of Drafts by Year of Construction, 2001**



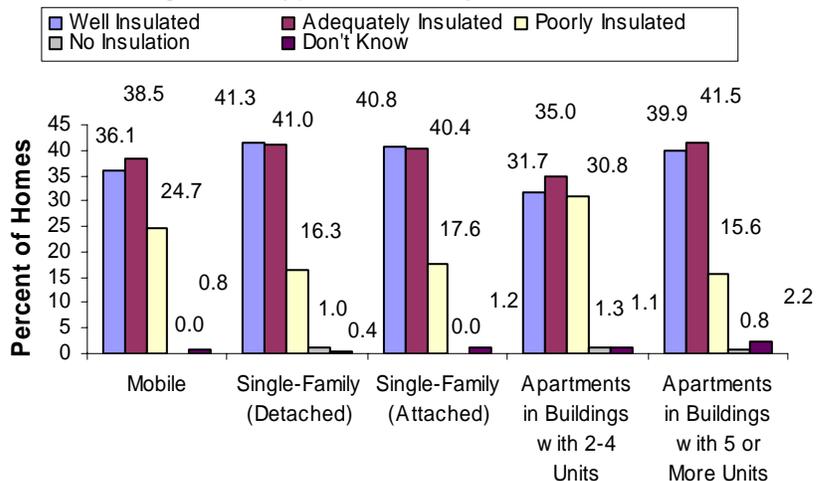
Source: Energy Information Administration, 2001 RECS.

**Figure 5. Distribution of Homes by Type of Housing, 2001**



Source: Energy Information Administration, 2001 RECS

**Figure 6. Type of Home by Insulation, 2001**



Source: Energy Information Administration, 2001 RECS.

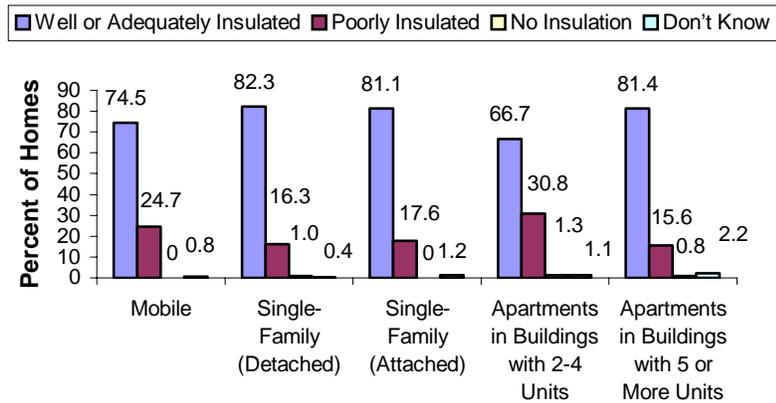
About 31 percent of apartments in small buildings and 25 percent of mobile homes were “poorly insulated,” compared with about 16 percent of detached single-family or apartments in large buildings, and 18 percent for attached single-family homes. With respect to the perceived adequacy of insulation, mobile homes and apartments in small buildings were statistically different from other types of homes. Furthermore, the percentage shares of “poorly insulated” units for apartments in small buildings were statistically different from those of apartments in large buildings.

### Winter Draft

Household judgments about winter drafts by type of housing unit were similar to the judgments about adequacy of insulation by type of unit. Of the apartments in small buildings, an estimated 36 percent were “never” drafty, compared with more than 55 percent for detached single-family, 53 percent for attached single-family, 50 percent for mobile homes, and 47 percent for large apartments (Figure 7).

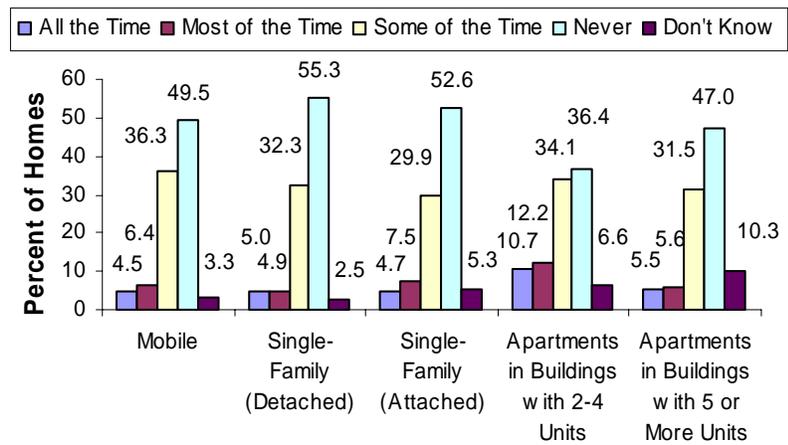
Among apartments in small buildings, an estimated 23 percent were either drafty “all the time” or “most of the time” (Figure 7a). The corresponding values were 11 percent for mobile homes, 10 percent for detached single-family homes, 12 percent for attached single-family homes, and 11 percent for apartments in large buildings.

**Figure 6a. Type of Home by Insulation, 2001**



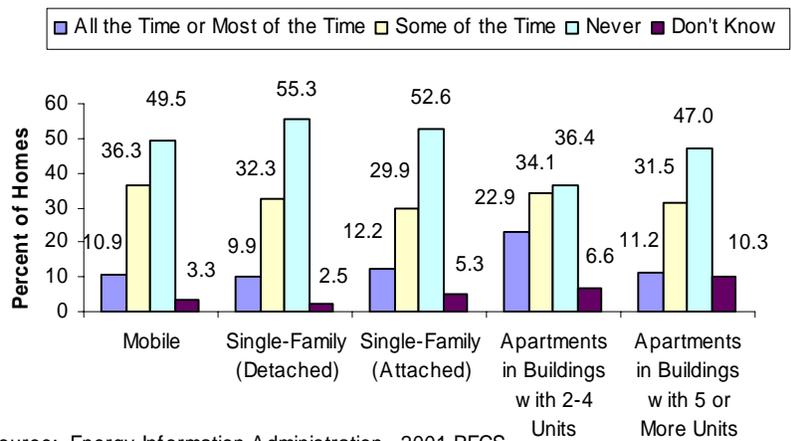
Source: Energy Information Administration, 2001 RECS.

**Figure 7. Type of Home by Level of Drafts, 2001**



Source: Energy Information Administration, 2001 RECS.

**Figure 7a. Type of Home by Level of Drafts, 2001**

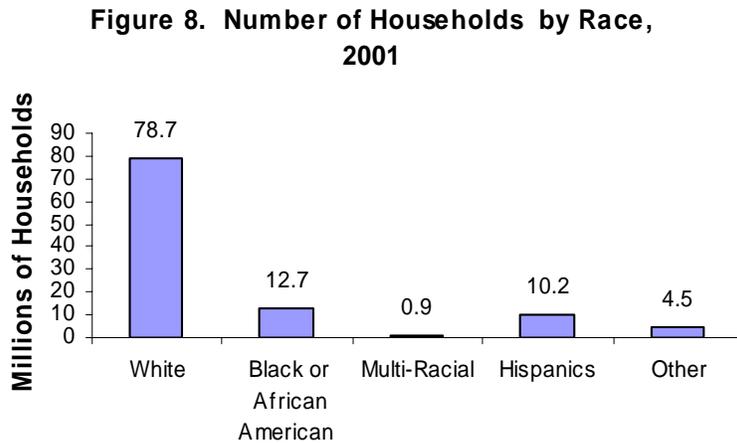


Source: Energy Information Administration, 2001 RECS.

## Householder's Race

For the purpose of the RECS, race is defined as the primary background of the person considered to be the householder as determined by the respondent (which may or may not be the householder). Each respondent was asked, "Which describes your/the householder's race? You can select one or more categories." The group included "American Indian or Alaskan Native," "Asian," "Black or African-American," "Native Hawaiian or Other Pacific Islander," "White," "Other" (if volunteered), "Hispanic" (if volunteered), and "Do not know." In 2001, an

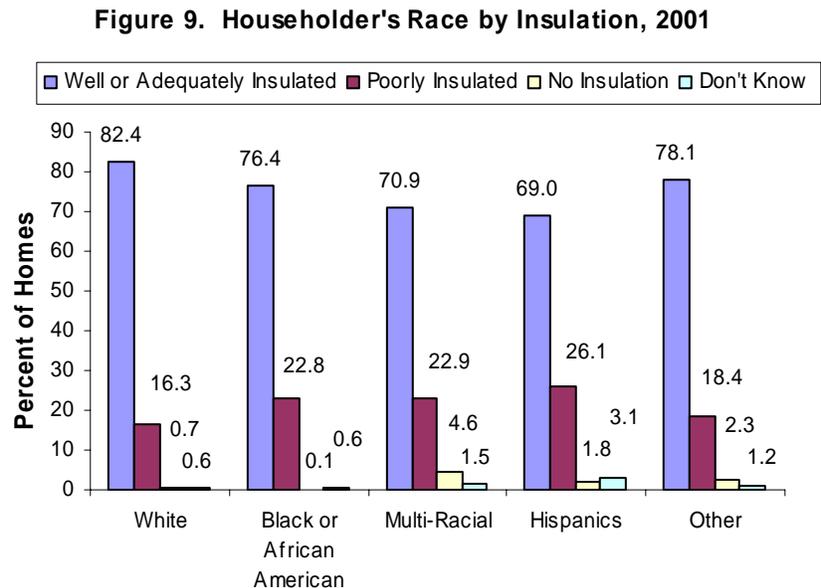
estimated 74 percent of householders were categorized as "non-Hispanic white" householders, 12 percent "non-Hispanic Black" householders, 1 percent as multi-racial, 4 percent as "other" (includes Native American, Native Alaskan, Asian, and Pacific Islander householders), and 9 percent as "Hispanic" householders. Figure 8 shows the number of households by race.



Source: Energy Information Administration, 2001 RECS.

## Insulation

According to the RECS data, "white" householders were living in significantly better insulated housing units than were "Black" householders and "Hispanic" householders. Nevertheless, the estimated proportions of householders with either "well insulated" or "adequately insulated" units were rather high for all of these subgroups, 82 percent, 76 percent, and 69 percent, respectively (Figure 9). The RECS data show that among "white" householders, 16 percent of homes were "poorly insulated," compared with 23 percent for "Black" householders and 26 percent for "Hispanic" householders.



Source: Energy Information Administration, 2001 RECS.

## Winter Draft

The RECS data show that among “white” householders, less than 5 percent lived in homes that were drafty “all the time” (Figure 10). The proportion for “white” householders that lived in houses that were drafty “all the time” was statistically different than the proportions in “Black” householders (8 percent) and “Hispanic” householders (9 percent). An estimated 56 percent of “white” householders indicated that they “never” found their homes too drafty during the winter months. The proportion was statistically different for “Black” householders (40 percent) and “Hispanic” householders (41 percent).

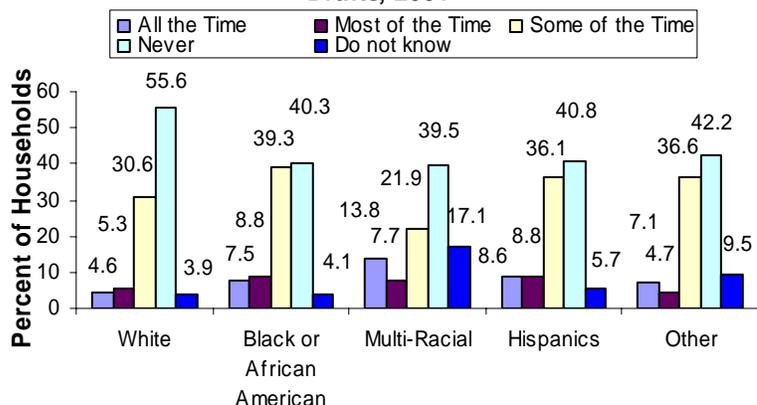
## Householder Ownership

In 2001, an estimated 68 percent of households in the United States were owner occupied and 31 percent were rented. About one percent resided in occupied homes without paying rent.

## Insulation

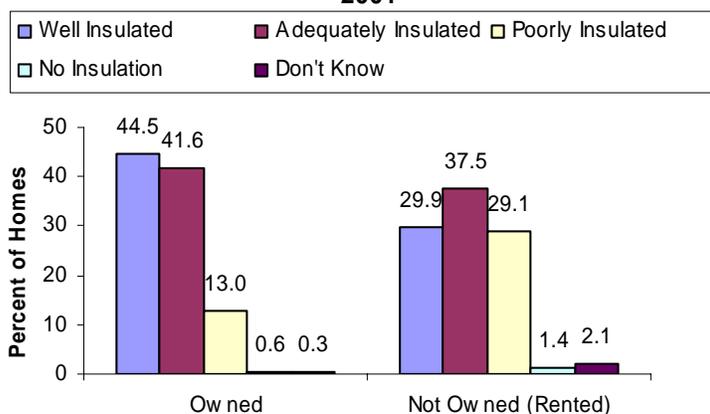
According to RECS data, owned homes were statistically significantly better insulated than were rented units (including rent-free units). Among owner-occupied homes, 45 percent were “well insulated” and 42 percent were “adequately insulated.” In rented homes, 30 percent were perceived to be “well insulated” and about 38 percent were perceived to be “adequately insulated.” (Figure 11). In addition, the estimated percentage of “poorly insulated” homes was higher among rented units (29 percent) than owner-occupied units (13 percent). It is a reasonable assumption that homeowners may know more about the level of insulation in their homes than those who rent.

**Figure 10. Housholder's Race by Level of Drafts, 2001**



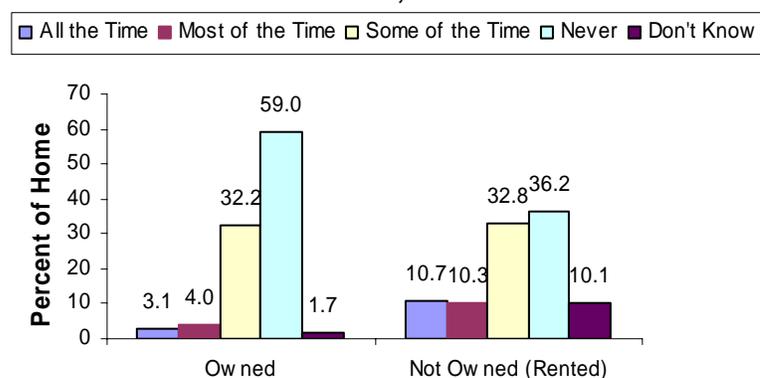
Source: Energy Information Administration, 2001 RECS.

**Figure 11. Ownership of Home and Insulation, 2001**



Source: Energy Information Administration, 2001 RECS.

**Figure 12. Ownership of Home by Level of Drafts, 2001**



Source: Energy Information Administration, 2001 RECS.

## Winter Draft

Not surprisingly, household perceptions regarding the level of drafts were similar to their perception about insulation. Unlike insulation, the knowledge of drafts should be the same for homeowners and renters (Figure 12). In rented homes, 11 percent said they were drafty “all the time” and 10 percent were drafty “most of the time,” compared with 3 percent and 4 percent for owner-occupied units, respectively. The majority (59 percent) of owner-occupied homes “never” experienced drafty homes, while the proportion for rented homes was 36 percent. About 10 percent of households residing in rented units indicated that they “do not know” whether their homes were drafty, compared with less than 2 percent for owner-occupied homes.

## Poverty

The RECS data show that about 14 percent of households were living below the 100-percent poverty level.<sup>8</sup> About 34 percent of these households were owner occupied. Although there were statistically significant differences between households below the 100-percent poverty level and other households, the actual differences between subgroups are not large. The majority of households in each subgroup perceived their homes to be well insulated.

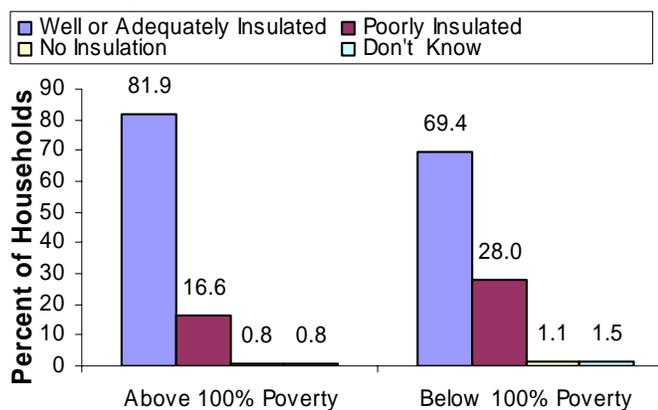
## Insulation

An estimated 82 percent of households above the poverty level considered their home to be either “well insulated” or “adequately insulated,” and less than 17 percent considered their home to be “poorly insulated” (Figure 13). Nearly 69 percent of households below the poverty level considered their home to be either “well insulated” or “adequately insulated” and 28 percent considered their home to be “poorly insulated.”

## Winter Draft

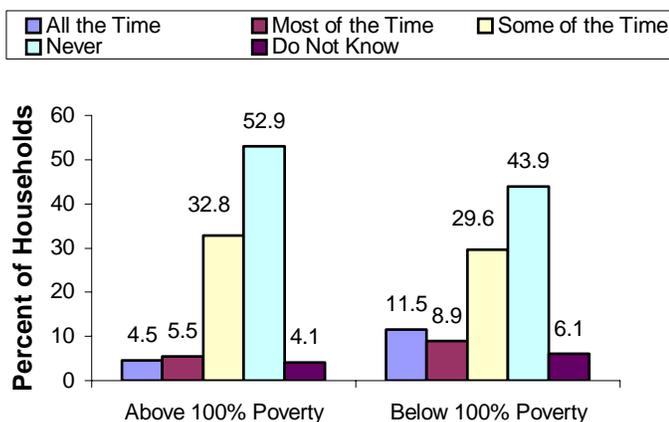
The RECS data indicate that about 12 percent of households below the poverty level felt that their homes were drafty “all the time” and 9 percent were drafty “most of the time” (Figure 14). The estimated proportions for households above the poverty level were 5 percent and 6 percent, respectively. Among households below the poverty level, the

**Figure 13. Poverty by Insulation, 2001**



Source: Energy Information Administration, RECS 2001.

**Figure 14. Poverty by Level of Drafts, 2001**



Source: Energy Information Administration, 2001 RECS.

<sup>8</sup> RECS uses the poverty level defined by the U.S. Bureau of the Census. Because RECS income data were collected by using categories of income, an exact match with the Bureau of the Census thresholds for poverty could not be made.

RECS results show that 44 percent of homes were “never” too drafty during the winter months, compared with 53 percent for households above the poverty level.

## Location of Home: Cities, Towns, Suburbs, and Rural Areas

According to the RECS data, in 2001, 47 percent of homes were in cities, 17 percent were in towns, 20 percent were in the suburbs, and less than 17 percent were in rural areas (Figure 15). Household perceptions with respect to the adequacy of insulation and level of drafts in the home show that homes in the suburbs and rural areas were statistically significantly better insulated than those located in cities and towns.

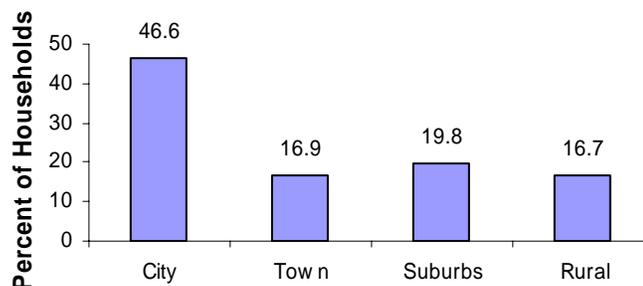
### Insulation

About 86 percent of homes in the suburbs and 84 percent of homes in rural areas were perceived to be either “well insulated” or “adequately insulated”(Figure 16), whereas, the proportion of homes located in towns and cities that were perceived to be either “well insulated” or “adequately insulated” were 77 percent and 78 percent, respectively. According to RECS data, 20 percent of the homes in the cities and 21 percent in the towns were perceived to be “poorly insulated.” Fewer homes in the suburbs and rural areas were perceived to be “poorly insulated”, 13 and 15 percent respectively.

### Winter Draft

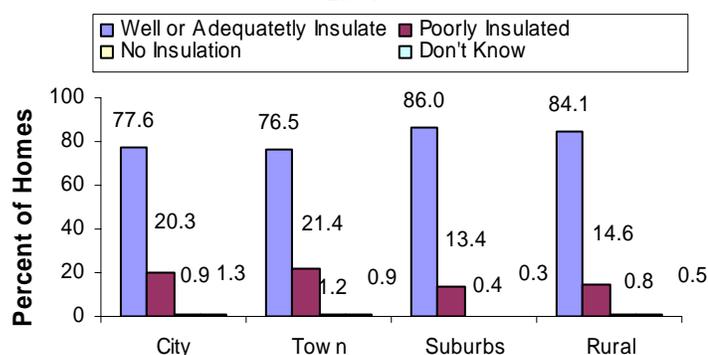
Based on the RECS data, the percentages of homes that were perceived to be either drafty “all the time” or “most of the time” were 13 percent and 14 percent in cities and towns, respectively (Figure 17). The percentages for the suburbs and rural areas were 9 percent and 10 percent, respectively. About 58 percent of homes in the suburbs and 56 percent of homes in rural areas were “never” drafty, compared with about 49 percent for homes located in cities or towns.

Figure 15. Distribution of Homes by Location, 2001



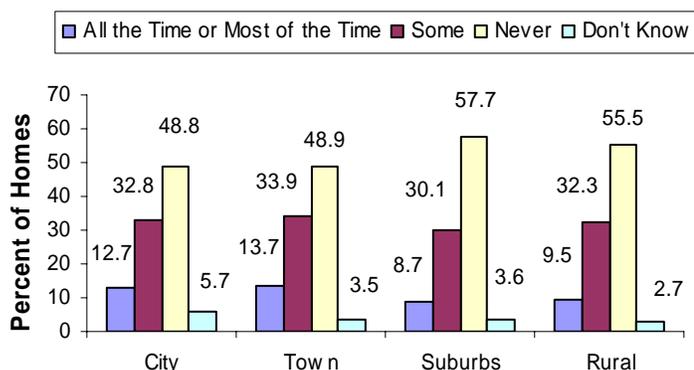
Source: Energy Information Administration, 2001 RECS.

Figure 16. Location of Home by Insulation, 2001



Source: Energy Information Administration, 2001 RECS.

Figure 17. Location of Home by Level of Drafts



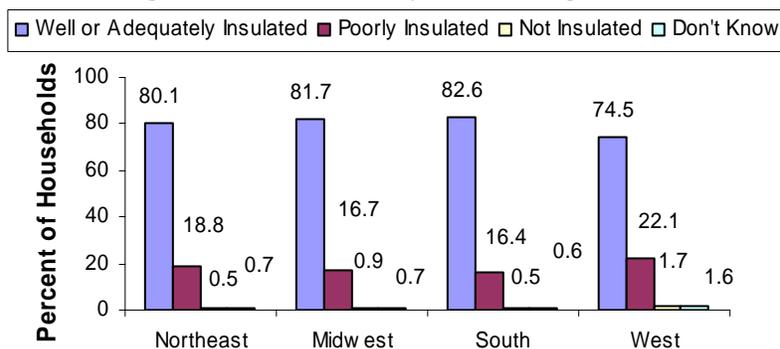
Source: Energy Information Administration, 2001 RECS.

## Location of Home: U.S. Census Regions

### Insulation

According to the RECS data, there were some variations with respect to the perceived adequacy of insulation by Census regions. As shown in Figure 18, the West had the lowest proportion of either "well insulated" or "adequately insulated" units (75 percent), whereas, the South had the highest proportion (83 percent). In addition, the West had the highest proportion of "poorly insulated" units (22 percent). The RECS data for the West were statistically significantly different from the Midwest and South in the share of "poorly insulated" units and the proportion of either "well insulated" or "adequately insulated" homes.

**Figure 18. Insulation by Census Regions, 2001**



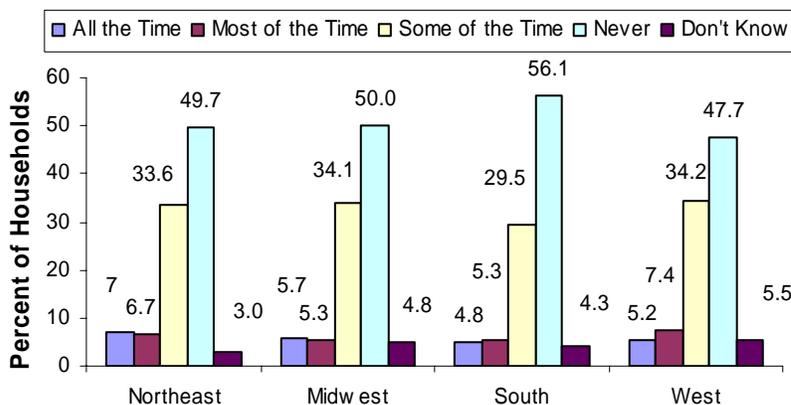
Source: Energy Information Administration, 2001 RECS.

### Winter Draft

The South had the highest percentage of housing units that were "never" drafty (Figure 19). In 2001, according to RECS data, 56 percent of the housing units in the South were perceived to be "never" drafty, compared with about 50 percent in the Northwest and Midwest and 48 percent in the West.

The level of insulation that is considered to be adequate may vary by region. Hence a home that is considered to be a "well insulated" home in the South may not be categorized as a "well insulated" home in the North. Therefore, the lack of a big difference between the perceived level in insulation in the South and in the Northeast or Midwest does not imply that the typical r-value of the insulation is the same for the regions.

**Figure 19. Level of Drafts by Census Regions, 2001**



Source: Energy Information Administration, 2001 RECS.

### Summary

In the past, using the RECS, EIA has tried to obtain technical information regarding the type of insulation in the home, and the r-value of the insulation. However, respondents usually do not know technical details of their homes. Thus, EIA relies on the RECS respondents to provide the energy-related details of their homes in another manner by asking questions that substitute, i.e., for insulation levels and building shell

construction. These new questions collect respondent self-assessment of the level of insulation and draftiness in the home.

With a few exceptions, comparisons of the perceived level of insulation and drafts in the home when comparing with building and household characteristics, and regional location produced similar results. Newly constructed homes are perceived to be better insulated and less drafty than older homes. About 63 percent of the households in new homes reported that their house or apartment was “well insulated” and two-thirds indicated that their resident was “never drafty,” compared with 28 percent and 40 percent for homes constructed before 1950.

The level of insulation and presence/absence of cold air drafts were different for homes of different types. About 67 percent of apartments in small buildings and 82 percent of detached single-family homes were either perceived to be “well insulated” or “adequately insulated,” based on RECS data. About 55 percent of detached single-family homes were perceived to be “never” drafty, compared with 36 percent in apartments in small buildings.

Households with different characteristics also perceived different levels of insulation and drafts in their homes. “White” householders, homeowners, and householders above the poverty level, all perceived their homes to be better insulated and less drafty. On the other hand, “non-white” householders, home renters, and householders below the poverty level perceived their homes to be less insulated and draftier.

Suburbanites and rural residents, when compared with city and town dwellers and householders residing in the South, when compared with those living in the West or the Midwest, all perceived to live in more insulated and less drafty homes.

## References

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